

Laparoscopic Subtotal Gastrectomy for Gastric Cancer

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ABSTRACT

Background: The use of laparoscopy in the treatment of gastric malignancy is still controversial. However, several reports suggest that the laparoscopic approach may be safe and applicable. The aim of this study was to review our experience with laparoscopic gastrectomy for gastric malignant tumors amenable to subtotal gastrectomy, and assess the oncologic outcome.

Methods: The laparoscopic approach to subtotal gastrectomy was selected according to both the surgeon's and patient's preference. Data regarding demographics, operative procedures, postoperative course, and follow-up were prospectively collected in a computerized database. Survival data were obtained from the national census.

Results: Twenty patients were operated on, 18 for gastric adenocarcinoma, one for gastric lymphoma, and one for gastrointestinal stromal tumor. There were 10 males and 10 females, mean age of 67. D1 subtotal gastrectomy with Billroth-2 reconstruction was performed. Mean operative time was 335 minutes. Tumor-free margins were obtained in all cases, and a mean of 15 lymph nodes were retrieved. Median postoperative hospital stay was 12 days. Postoperative complications included leak from the duodenal stump (2), intraabdominal abscess (2), anastomotic leak (1), wound infection (1), and bowel obstruction (1); reoperation was required in 4 patients. No perioperative mortality occurred in our series. Pathology showed nodal involvement in 8 patients. During a mean follow-up of 39 months, 4 patients expired from recurrent and metastatic disease; all had positive lymph nodes. The Kaplan-Meier calculated 5-year survival was 79%.

Conclusion: Although a challenging and lengthy procedure, laparoscopic subtotal gastrectomy yields acceptable surgical and oncologic results that may further improve with increased surgeon experience. Thus, the application

of laparoscopy in the surgical treatment of distal gastric malignancy may be considered; however, further data are needed before this approach can be recommended.

Key Words: Laparoscopy, Gastrectomy, Malignancy.

INTRODUCTION

Despite the rapid development and application of laparoscopy for a wide variety of pathologies, 2 major factors continue to limit its widespread use for gastric malignancy: technical complexity requiring advanced laparoscopic skills and concerns regarding oncologic safety. Specifically, the laparoscopic approach involves a lengthier and more complex procedure with the need for specialized equipment and a high level of dexterity. Thus, many surgeons opt for the traditional open technique, especially when dealing with malignancy, where concerns that the laparoscopic approach may not yield similar results to those achieved by open surgery, such as the extent of resection and recurrence. To adopt a radical change for the preference of laparoscopy over open surgery for gastric malignancy, justification must first be presented by way of a demonstrated significant advantage. For these reasons, laparoscopic gastric resection is not currently widely practiced, and as a result data relative to its safety and efficacy are limited.

Another limiting factor in reaching any evidence-based conclusions regarding laparoscopy for gastric malignancy is the relatively low incidence of this type of cancer in the Western hemisphere. Conversely, colonic cancer has a much wider prevalence that has allowed for a plethora of data establishing the safety of laparoscopic colectomy. In Japan, for example, where the incidence of gastric cancer is higher, laparoscopic gastrectomy has been performed for more than 10 years.¹ However, it may be difficult to extrapolate from the Japanese experience, because more stringent population screening leads to earlier detection. In addition, even when diagnosed at an operable stage, the overall prognosis of gastric cancer is more dismal in Western countries than in Japan.

Although reported results are limited, based on the prom-

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using experiences of laparoscopic gastrectomy from several European and North American Centers, in 2001 we started to perform laparoscopic gastrectomy at our institution. The aim of this study was to review our experience with laparoscopic subtotal gastrectomy for gastric malignancy, focusing specifically on the perioperative course and postoperative oncologic results.

METHODS

Patient Selection

All patients diagnosed with resectable gastric malignancy at the distal stomach between 2001 and 2006 were potentially eligible for laparoscopic gastric resection. Patients were selected for the laparoscopic approach based on both the surgeon's and patient's preference. Tumor size was not considered as an exclusion criterion. The final decision regarding the selected surgical approach was made by the operating surgeon. The choice of subtotal gastrectomy was based on the location of the tumor in the stomach, which allowed sufficient resection margins with ample residual proximal stomach for the creation of the gastrojejunal anastomosis.

Data Collection and Analysis

Data regarding patient demographics, type of surgery, intraoperative and postoperative course, including complications and repeat procedures, pathologic results, adjuvant and neoadjuvant therapy, and long-term follow-up, including late complications, local recurrence, metastatic spread, and survival were prospectively entered into a computerized database and retrospectively analyzed. Early postoperative complications were defined as those occurring immediately following surgery or within 2 weeks after the procedure. Follow-up data were obtained from the patient's routine outpatient clinic visits. National census data were used to determine survival time.

Operative Technique

Surgery was performed with the patient in the supine position and the surgeon standing between the patient's legs. Abdominal entry was made immediately above the umbilicus, by the open Hasson technique (for patients who had prior surgery) or a Veress needle, for initial CO₂ insufflation; 4 additional ports were usually necessary to complete the procedure.

Abdominal exploration was initially performed to rule out metastatic spread. The tumor location at the stomach was

confirmed visually and by instrumental palpation, to determine the appropriate surgical procedure. Resection commenced with mobilization of the omentum from its attachments to the transverse colon, for inclusion in the surgical specimen. This dissection allows entry into the lesser sac to examine the posterior gastric wall and rule out posterior tumoral penetration into the pancreas (**Figure 1**). Further dissection was carried out distally, along the greater curve of the stomach, towards the gastric outlet; care was taken to avoid the transverse mesocolon while transecting the right gastroepiploic artery. The first part of the duodenum was then dissected and transected using a linear stapler; sutures were usually added to reinforce the duodenal closure. Proximal dissection along the greater curvature was then carried out to the proximal tumor margins, at least 5cm from the tumor. The short gastric vessels to the spleen were then transected to a height depending on the level of transection. At this stage, dissection was continued at the lesser curvature side of the stomach, with division of the right gastric artery near the antrum. The left gastric artery is usually divided at its origin if high transection is required or at its branches if more proximal stomach is to be retained. Generally, perigastric lymph nodes were removed with the specimen (D1 dissection), and no attempt was made to dissect distant nodes (D2 dissection), unless evidently enlarged (similar to our open approach).

After dissection was completed, the stomach was horizontally transected using several cartridges of a linear cutting stapler (**Figure 2**). The specimen was removed in a col-

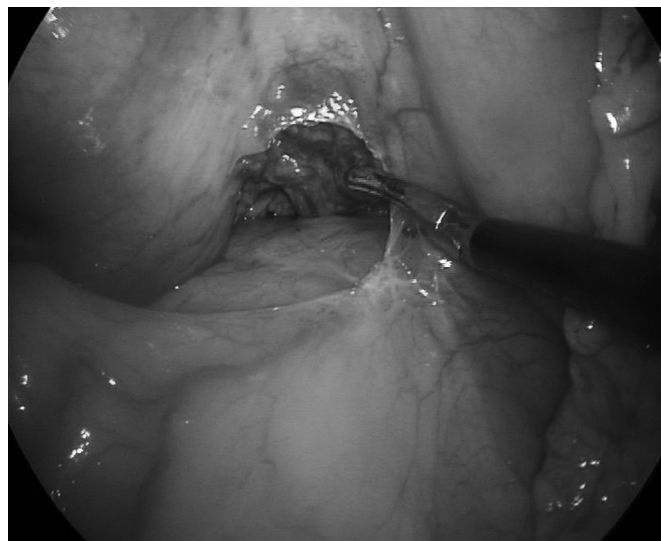


Figure 1. Lesser sac entry and examining posterior gastric wall and pancreas.



Figure 2. Gastric transection using a linear stapler.

lection bag through a 4-cm to 5-cm upper abdominal incision. Frozen section pathologic examination of the surgical margins was carried out to ensure tumor-free margins before proceeding with the anastomosis.

Gastrointestinal tract continuity was restored in a “Billroth 2” configuration, whereby a jejunal loop was anastomosed to the gastric stump. The bowel was passed anterior to the transverse colon, and anastomosed to the posterior gastric wall using a 60-mm linear cutting stapler, with hand-sewn closure of the remaining opening; a suction drain was placed near the duodenal stump.

RESULTS

Of nearly 40 eligible patients, 20 [10 males, 10 females; mean age 67 years (range, 33 to 91)] were selected for laparoscopic operation over a period of 5 years. Indications for surgery included adenocarcinoma in 18 patients, lymphoma in one, and gastrointestinal stromal tumor (GIST) in another. All tumors were located in the distal part of the stomach and were amenable to subtotal gastrectomy. No patients required neoadjuvant oncologic treatment. Adjuvant treatment was offered to patients at a high risk of experiencing a recurrence (Stage above T2N0, poorly differentiated tumor).

All procedures were completed laparoscopically (no conversion to open surgery were needed). In 2 patients, intraoperative endoscopy was required to assist in locating a tumor that was not visible or palpable using the laparoscopic equipment. The mean operating time was

335 minutes (range, 189 to 452). An intraoperative complication occurred in only one patient, wherein the esophageal thermometer was mistakenly placed in the stomach and subsequently included in the staple line, necessitating extension of the resection and refiring of the stapler.

Nine early postoperative complications occurred in 6 (30%) of the patients (**Table 1**). Duodenal stump leak, occurring in 2 patients in whom the staple line was not reinforced, was conservatively treated in one patient but required reoperation in the other. Two patients developed an intraabdominal abscess; one was drained percutaneously, and the other was drained by repeat laparoscopy. Leak from the gastrojejunal anastomosis led to reexploration in one patient (who also had a duodenal stump leak), revealing ischemia of the proximal stomach. Extension of the gastric resection with reanastomosis to the small bowel led to eventual recovery.

Wound infection in the specimen extraction site developed in one patient, in whom a wound protector was not used for specimen extraction. One patient, in whom the jejunal loop was passed through the mesocolon, experienced excessive pressure at this site, which subsequently led to obstruction requiring reexploration. Urinary retention and pneumonia occurred in one patient each. Overall, 4 patients (20%) required reexploration, which was accomplished laparoscopically in one case. Median Postoperative Hospital Stay was 12 Days (Range, 5 to 108).

Based on the pathology report, the surgical margins were tumor-free in all cases, and proximal margins measured on average 5.2cm (range, 2 to 14). Four patients with adenocarcinoma had T1 lesions, 5 had T2, and 9 had T3. There were an average of 15 lymph nodes (range, 5 to 61,

Table 1.
Postoperative Complications

Complication	Number	%
Wound infection	1	5
Anastomotic leak	1	5
Duodenal stump leak	2	10
Abdominal abscess	2	10
Bowel Obstruction	1	5
Urinary retention	1	5
Pneumonia	1	5
Overall patients with complication (one or more)	6	30
Reoperation	4	20
Mortality	0	0

median, 13) in the surgical specimen, and lymph node involvement was noted in 8 patients (40%).

At a mean long-term follow-up of 39 months (range, 4 to 74), no port-site recurrence was observed. Four (20%) patients had expired due to recurrent disease and metastatic spread, all with lymphatic involvement at the time of surgery. The Kaplan-Meier calculated 5-year survival was 79% (**Figure 3**).

DISCUSSION

Laparoscopy is one of the most significant surgical advances in the past century and has been rapidly applied to the treatment of a wide array of abdominal pathologies. Prior to adoption, the process of evaluating new techniques involved addressing several key issues: Is it feasible? Is it safe? Is it efficacious? Is it superior to the current practice? Although the laparoscopic approach was deemed preferable over its open counterpart for several procedures, gastrectomy has remained a procedure in which the open approach is prevalent and, in fact, preferred by most surgeons. However, applying the laparoscopic technique for the resection of low-grade malignant gastric tumors, such as gastrointestinal stromal tumors (GIST),²⁻⁴ is gaining more popularity, because a wedge excision is usually sufficient. In Asia, the prevalence of gastric malignancy is significantly higher than in the West, and stringent population screening allows for earlier detection of gastric cancer, thus the laparoscopic approach is rapidly gaining popularity. Despite the more limited experience with laparoscopic surgery for more advanced tumors, it seems to follow this trend, both in Asia^{5,6} and in some Western centers.⁷⁻⁹ Although the number of patients

operated on laparoscopically for advanced gastric cancers is small, preliminary reports suggest that feasibility is not an obstacle when highly trained advanced laparoscopic surgeons perform the procedure.⁹

The safety of the laparoscopic approach should be determined using 2 criteria: short-term peri-operative results and long-term oncologic outcome. In this respect, accumulating data suggest that the surgical procedure can be accomplished laparoscopically with acceptable morbidity and mortality, similar to those results achieved by the open technique, while maintaining the advantages of laparoscopic surgery, such as reduced operative trauma.¹⁰

In our preliminary experience with laparoscopic subtotal gastrectomy for advanced gastric tumors, early postoperative morbidity was significant at 30%. In all likelihood, this reflects the learning curve phase, which may be more prolonged due to the relatively small number of gastric cancers seen in our population.

More important is the question of oncologic safety and the long-term outcome after laparoscopic gastrectomy for malignancy. Our results suggest that the surgical specimen was adequate, based on clear surgical margins and the number of retrieved lymph nodes. Other series that compared laparoscopic with open gastric resection have also reported no significant difference in these parameters.¹¹⁻¹⁴ A relatively small number of trials, providing long-term comparative results, have shown that outcome after laparoscopic surgery is not inferior to outcome with the open counterpart.^{9,15,16}

For the laparoscopic technique to be considered superior to the open approach, advantages should outweigh drawbacks like a longer operative time, higher costs, and steep learning curve. The potential advantages of laparoscopic surgery, such as faster postoperative recovery, earlier resumption of gastrointestinal function, attenuated immune depression, decreased postoperative pain, and shorter hospital stay have been suggested in several comparative studies.^{13,14,17}

In our study, 20 patients underwent laparoscopic distal subtotal gastrectomy. The majority of resections were undertaken for gastric adenocarcinoma. All tumors had variable gastric wall involvement without penetration to the adjacent organs. Although this was a noncomparative study, our overall results are in keeping with those reported in previous studies.^{12,16} It is important to stress that, in our experience, the potential advantages of laparoscopy resulting from less operative trauma and faster recovery were mainly seen in patients with an uneventful

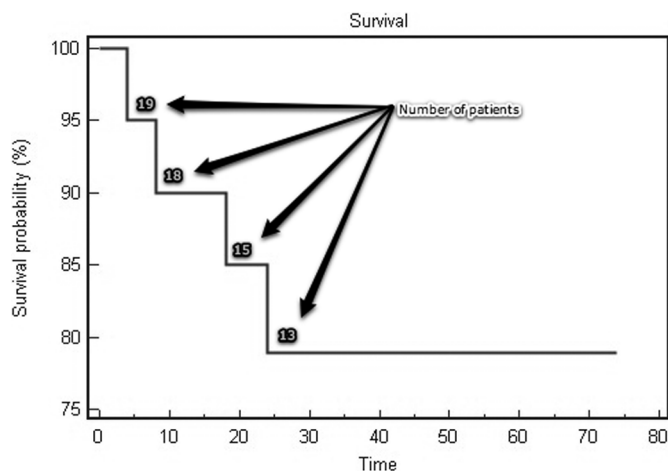


Figure 3. Kaplan-Meier Survival probability curve (time in months).

postoperative course. It appears that, once complications do occur, patients are less likely to be afforded the advantages of a laparoscopic technique. Recent technical and instrumental advances, such as the use of wound protectors, may potentially decrease complications like wound infection and port-site metastases. Our personal bias favors suture reinforcement of the duodenal stump, aimed at reducing the suture line leak rate; however, the small number of patients included in our series precludes any definitive results.

Despite the limited number of patients, the long-term survival in our series was comparable to survival reported in larger series of open gastric resection for cancer and other series of laparoscopic resection, with a 5-year survival rate of 79%.^{12,16}

CONCLUSION

The results of our study suggest that laparoscopic subtotal gastrectomy for gastric cancer is feasible, with a favorable long-term outcome. These results are in line with previously reported series, suggesting that, with appropriate expertise, the laparoscopic approach is safe and applicable, and provides a valid alternative to the open approach. However, larger series comparing the laparoscopic and open techniques are required before the laparoscopic approach can be recommended as the preferred alternative.

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